

IN THE CLAIMS:

Please note that all claims currently pending and under consideration in the referenced application are shown below, in clean form, for clarity. Claims 16, 28, 29, and 30 have been amended herein. Please enter the claim as amended. Please cancel claims 24 and 26. Also attached is a version with markings to show changes made to the claims.

2 16. (Amended) A process for producing alkyl esters useful in biofuels and lubricants, said process comprising:

providing an organic composition comprising one or more components selected from the group consisting of acylglycerols, fats, oils, waxes, and free fatty acids;

providing a critical fluid medium including one or more fluids selected from the group consisting of carbon dioxide, sulfur dioxide, methane, ethane, propane, and mixtures thereof;

dissolving the organic composition and a C₁-C₄ short chain alcohol into the critical fluid medium;

reacting the organic composition with the short chain alcohol in the presence of a catalyst in a single phase to produce a final product comprising an alkyl ester and glycerol, wherein said glycerol leaves the single phase as it is formed;

separating the glycerol from the alkyl ester; and

separating the alkyl ester from the critical fluid medium,

wherein the particular critical fluid medium is selected so that, when combined with the organic composition, the critical fluid medium provides decreased loss of catalyst or catalytic activity and elimination of mass transfer limitations by maintaining the various reactants in a single phase.

17. The process of claim 16, wherein said short chain alcohol is selected from the group consisting of ethanol, methanol, propanol, butanol, isopropanol and isobutanol.

18. The process of claim 16, wherein said catalyst is a liquid phase catalyst.

19. The process of claim 18, wherein said liquid phase catalyst is selected from the group consisting of HCl, H₂SO₄, HNO₃, NaOH, and KOH.

20. The process of claim 16, wherein said catalyst is a solid phase catalyst.

21. The process of claim 20, wherein said solid phase catalyst is a microporous crystalline solid.

22. The process of claim 20, wherein said solid phase catalyst is an exchange resin with either acidic or basic properties.

23. The process of claim 20, wherein said solid phase catalyst is an inorganic oxide selected from the group consisting of alumina, silica, silica-alumina, boria, oxides of phosphorus, titanium dioxide, zirconium dioxide, chromia, zinc oxide, magnesia, ion exchange resins, silicate catalysts, and calcium oxide either unmodified or modified with chlorine, fluorine, sulfur or an acid or base.

25. The process of claim 16, further comprising recycling said critical fluid medium for use in a later reaction.

27. The process of claim 16, wherein said critical fluid medium optionally includes a critical fluid co-solvent selected from the group consisting of methanol, ethanol, butanol, and water.

D3 28. (Amended) A process for producing alkyl esters useful in biofuels and lubricants, said process comprising:

providing an organic composition comprising one or more components selected from the group consisting of acylglycerols, fats, oils, waxes, and free fatty acids;

D3
cont.
providing a critical fluid medium including one or more fluids selected from the group consisting of carbon dioxide, sulfur dioxide, methane, ethane, propane, and mixtures thereof, and optionally including one or more critical fluid co-solvents selected from the group consisting of methanol, ethanol, butanol, and water;

dissolving the organic composition and a C₁-C₄ short chain alcohol into the critical fluid medium;

reacting the organic composition with the short chain alcohol in the presence of a catalyst in a single phase to produce a final product comprising an alkyl ester and glycerol, wherein said glycerol leaves the single phase as it is formed;

separating said glycerol from said final product by modifying the temperature and pressure of the final product; and

separating said alkyl ester product from said critical fluid by modifying the temperature and pressure of the critical fluid medium.

29. (Twice Amended) A process for producing alkyl esters useful in biofuels and lubricants, said process comprising:

providing an organic composition comprising one or more components selected from the group consisting of acylglycerols, fats, oils, waxes, and free fatty acids;

providing a critical fluid medium including one or more fluids selected from the group consisting of carbon dioxide, sulfur dioxide, methane, ethane, propane, and mixtures thereof;

dissolving the organic composition and a C₁-C₄ short chain alcohol into the critical fluid medium; and

reacting the organic composition with the short chain alcohol in the presence of a catalyst at a temperature from about 20°C to about 200°C and a pressure from about 150 psig to about 4000 psig, wherein the reaction occurs in a single phase to produce a final product comprising an alkyl ester and glycerol and wherein said glycerol leaves the single phase as the glycerol is formed;

wherein the critical fluid medium is selected such that a reaction temperature is within about 20% of a critical temperature of the critical fluid medium and a reaction pressure is within about 0.5 to about 15 times a critical pressure of the critical fluid medium as modified by a co-solvent.

30. (Amended) A process for producing alkyl esters useful in biofuels and lubricants, said process comprising:

providing an organic composition comprising one or more components selected from the group consisting of acylglycerols, fats, oils, waxes, and free fatty acids;

dissolving the organic composition and a C₁-C₄ short chain alcohol into a critical fluid medium, wherein the critical fluid medium is one or more fluids selected from the group consisting of carbon dioxide, sulfur dioxide, methane, ethane, and propane, and mixtures thereof, the critical fluid medium solubilizing the organic composition and the C₁-C₄ short chain alcohol into a single phase;

reacting the organic composition with the C₁-C₄ short chain alcohol in the presence of a catalyst in the single phase; and

producing a final product comprising an alkyl ester and glycerol, wherein the glycerol is separated from the alkyl ester by controlling the temperature and pressure of the reaction conditions.